

Rev. 10/93

REMARKS

Claims 1-11 are cancelled and new claims 12-19 are added to more particularly point out and distinctly claim the process. New claim 12 is a Jepson-style claim which more distinctly points out the claimed improvement. Support for new claim 12 will be found throughout the specification and the Examples, in particular on page 4, line 29 to page 5, line 2 and lines 27-34. Additionally, detecting titanium oxychloride formed in the vanadium passivated discharge and, if absent, mixing the aluminum passivating agent in an amount to passivate the aluminum chloride and react with the titanium tetrachloride to form titanium oxychloride will be found on page 5, lines 9-14, page 4, line 34 to page 5, line 2, page 6, lines 2-19, page 7, lines 17-23, page 8, lines 27- page 9, line 2, also see Examples 1 and 2 and proviso (ii) of original claim 1.

Original claims 1-11 were rejected for indefiniteness under 35 U.S.C. 112, second paragraph on the grounds that proviso (i) makes it unclear whether the aluminum passivating agent is positively required to be mixed with the discharge and lack of clarity of provisos (i) and (ii) with regard to certain sequences for mixing the aluminum passivating agent. However, new claim 12 makes it clear that aluminum passivating agent is positively required to be mixed with the discharge if titanium oxychloride is absent in the vanadium passivated discharge. Claims directed to mixing aluminum passivating agent simultaneously with or before the vanadium passivating agent are cancelled.

By way of background, the inventors surprisingly recognized that the product of passivation of vanadium oxychloride in crude titanium tetrachloride discharge with an organic oil forms a passivating agent for aluminum chloride, which is not taught in the prior art. Moreover, the inventors recognized that detecting titanium oxychloride, which would have been a waste stream, in the vanadium passivated discharge, indicated aluminum chloride passivation. In the absence of the inventors' discovery that a passivating agent for aluminum chlorides forms from passivation of vanadium chlorides, it would not have been obvious to the person of ordinary skill in the art of crude titanium tetrachloride passivation to detect titanium oxychloride in the vanadium passivated discharge in order to recognize that only if titanium oxychloride is absent is an aluminum chloride passivating agent required.

Vanadium passivated titanium tetrachloride streams can contain tenacious solids, as high as 50 to 60%, which are difficult to deal with in analytical equipment.

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For this reason, vanadium passivated streams do not easily lend themselves to analysis for substances such as titanium oxychloride.

Now turning to the Office action, claims 1-11 are rejected as obvious over US 4,246,022 of Robinson ("the Robinson patent"), or British Patent 744,074 ("GB '074") in view of US published patent application NO. 2001/0016182 ("the Cronin et al. publication").

The Robinson patent relates to purification of titanium tetrachloride by treatment with mineral oil. The Robinson patent is silent on detecting the amount of titanium oxychloride present in the mineral oil sludge residue. Additionally, the percentage of each component of the residue listed in the Example of the Robinson patent adds up to 100% but titanium oxychloride is not listed. The Robinson patent is also silent on aluminum chloride passivating with a passivating agent selected from the group consisting of water, water containing solutions, water containing mixtures and carboxylic acids. Moreover, the Robinson patent teaches away from aluminum chloride passivation during vanadium passivation since the Examples of Robinson (see Col. 4) teach the presence of aluminum chloride in the vanadium passivated product.

GB '074 relates to treatment of crude titanium tetrachloride containing vanadium, silica, alumina, niobium and tungsten by contacting the crude titanium tetrachloride with animal wax to form a hard granular residue which contains titanium dioxide, vanadium, and small amounts of silica, alumina, tungsten, niobium and other impurities, the vanadium being in the form of VCl_3 and/or VOCl_3 . GB '074 fails to teach or suggest passivating aluminum chloride or that an aluminum passivating agent forms from mixing the vanadium passivating agent with the crude titanium tetrachloride. GB '074 is silent on aluminum chloride passivating with a passivating agent selected from the group consisting of water, water containing solutions, water containing mixtures and carboxylic acids.

The Cronin publication relates to mixing an aluminum chloride-passivating agent into the chlorinator discharge to form an essentially non-corrosive aluminum containing compound and titanium oxychloride. The Cronin publication teaches that the titanium oxychloride passivates the aluminum chloride which solves downstream corrosion problems and yield loss. The Cronin publication is silent on mixing a vanadium passivating agent into the chlorinator discharge, detecting the absence of

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titanium oxychloride in the vanadium passivated discharge for mixing the aluminum passivating agent into the vanadium passivated discharge.

Nothing in the Robinson patent or GB '074 or the Cronin et al. publication suggests detecting the absence of titanium oxychloride in vanadium passivated discharge and adding aluminum chloride passivating agent if the absence of titanium oxychloride is detected. Since it was not known that detecting titanium oxychloride in the discharge treated with the vanadium passivating agent would indicate that all the aluminum chloride had been passivated, it would not have been obvious to modify the disclosures relating to vanadium passivating processes and combine the modified disclosures with the disclosures relating to passivating aluminum chloride and then add the unknown step of detecting titanium oxychloride in the vanadium passivated discharge in order to mix an aluminum passivating agent if titanium oxychloride is not detected.

Thus, it would not have been obvious to the person of ordinary skill in the art to combine the Robinson et al. disclosure or GB '074 with the teaching of Cronin et al. since none of the cited references suggest that a reaction product of the vanadium passivation passivates the aluminum chloride. Also, it would not have been obvious from the references directed to passivating vanadium (Robinson or GB '074) to detect the titanium oxychloride of the vanadium passivated discharge and mix an aluminum passivating agent into the vanadium passivated discharge if titanium oxychloride is absent.

A person of ordinary skill in the art would not have considered the teaching in the Robinson patent that titanium tetrachloride treated with the mineral oil produces "a mineral oil sludge residue often containing aluminum chloride, niobium chloride and vanadium chloride", see Col. 1, lines 40-43 and the Example, to suggest combining Robinson et al. with the Cronin et al. publication to arrive at the claimed process especially since the residue described in the Robinson et al. patent is said to contain aluminum chloride and titanium oxychloride is not listed as a component of the residue.

Claims 1-11 were additionally rejected as being obvious to a person of ordinary skill in the art over US 2,600,881 ("the Kay et al. patent") in view of US 2,592,021 (the Frey et al. patent") and the Cronin publication.

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The Kay et al. patent at Col. 5, lines 6-36, teaches that water, which can be used to passivate aluminum chloride, first reacts with titanium tetrachloride to form titanium oxychloride which passivates the aluminum chlorides and that excess water as an aluminum chloride passivating agent causes titanium yield loss since the titanium oxychloride is a waste stream. Thus, the Kay et al. patent teaches careful control of water to passivate aluminum chloride. The Kay et al. patent teaches distilling the aluminum chloride passivated in the presence of copper to remove the discoloration caused by vanadium impurities, see Examples II and III. Kay et al. does not teach or suggest an organic oil as a vanadium passivating agent. The Kay et al. patent is silent on forming an aluminum passivating agent in the vanadium removal step. The Kay et al. patent is also silent on measuring titanium oxychloride of the vanadium passivated discharge in order to determine the need for an aluminum chloride passivating agent if titanium oxychloride is absent.

The Frey et al. patent relates to the use of hydrocarbons to purify liquid chlorides of metals of the 4th group of the periodic system, such as titanium. The process of the Frey et al. patent is said to remove vanadium impurities from titanium tetrachloride, see Example 1. Nothing in the Frey et al. patent teaches or suggests that an aluminum passivating agent forms from passivating the vanadium impurities. The Frey et al. patent fails to teach or suggest aluminum passivating agent selected from the group consisting of water, water containing solutions, water containing mixtures, and carboxylic acids. The Frey et al. patent is silent on titanium oxychloride formation in the vanadium passivated discharge or that formation of the titanium oxychloride in the vanadium passivated discharge indicates that the aluminum chloride is completely passivated.

The Cronin publication, as discussed above, relates to mixing an aluminum chloride-passivating agent into the chlorinator discharge to form an essentially non-corrosive aluminum containing compound and titanium oxychloride and monitoring the titanium oxychloride content to adjust the addition of aluminum passivating agent. Cronin further teaches that if titanium oxychloride is detected in the aluminum passivated product that all of the aluminum chloride is passivated. However, the Cronin publication is silent on mixing a vanadium passivating agent into the chlorinator discharge and detecting the absence of titanium oxychloride in the vanadium passivated discharge as an indicator for mixing aluminum chloride passivating agent. Moreover, the very difficult to analyze vanadium passivated stream leads away from analysis for substances such as titanium oxychloride.

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In view of the deficiencies of the Kay et al. patent, it would not have been obvious to modify the teaching of Kay et al. by the process of Frey et al. and the Cronin publication. None of the foregoing references, especially including the Frey et al. patent which relates to vanadium passivating, teach or suggest forming an aluminum passivating agent in the vanadium passivation step or detecting the absence of titanium oxychloride in the vanadium passivated discharge in order to mix aluminum chloride passivating agent into the passivated discharge. As such, the person of ordinary skill in the art would not have found it obvious to modify the disclosure of the Frey et al. patent and combine the modified disclosure with the Kay et al. patent and the Cronin et al. publication.

Since titanium oxychloride in vanadium passivated discharge was not known, the absence of titanium oxychloride in the vanadium passivated discharge was not obvious as an indicator that aluminum chloride passivating agent was needed to passivate aluminum chloride.

Passivating vanadium contained in crude titanium tetrachloride by adding certain organic materials described in Swiss Patent No. 262267; U.S. Patent No. 2,592,021 ("the Frey et al. patent"); Australian Patent No. 219385; and British Patent No. 744,074 in combination with aluminum chloride passivation processes would not have resulted in the claimed process because none of the cited references teach or suggest that mixing a vanadium passivating agent with the crude titanium tetrachloride forms an aluminum passivating agent or detecting titanium oxychloride in the vanadium passivated discharge, thus, combining the cited references as proposed in the Office action would not have arrived at the instant claims. Accordingly, it would not have been obvious to a person of ordinary skill in the art of titanium tetrachloride purification to arrive at the claimed process.

In view of the deficiencies of the cited references, it would not have been obvious to the skilled person to combine the references as suggested to arrive at the instant claims.

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In view of the foregoing, allowance of the above-referenced application is respectfully requested.

Respectfully submitted,



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